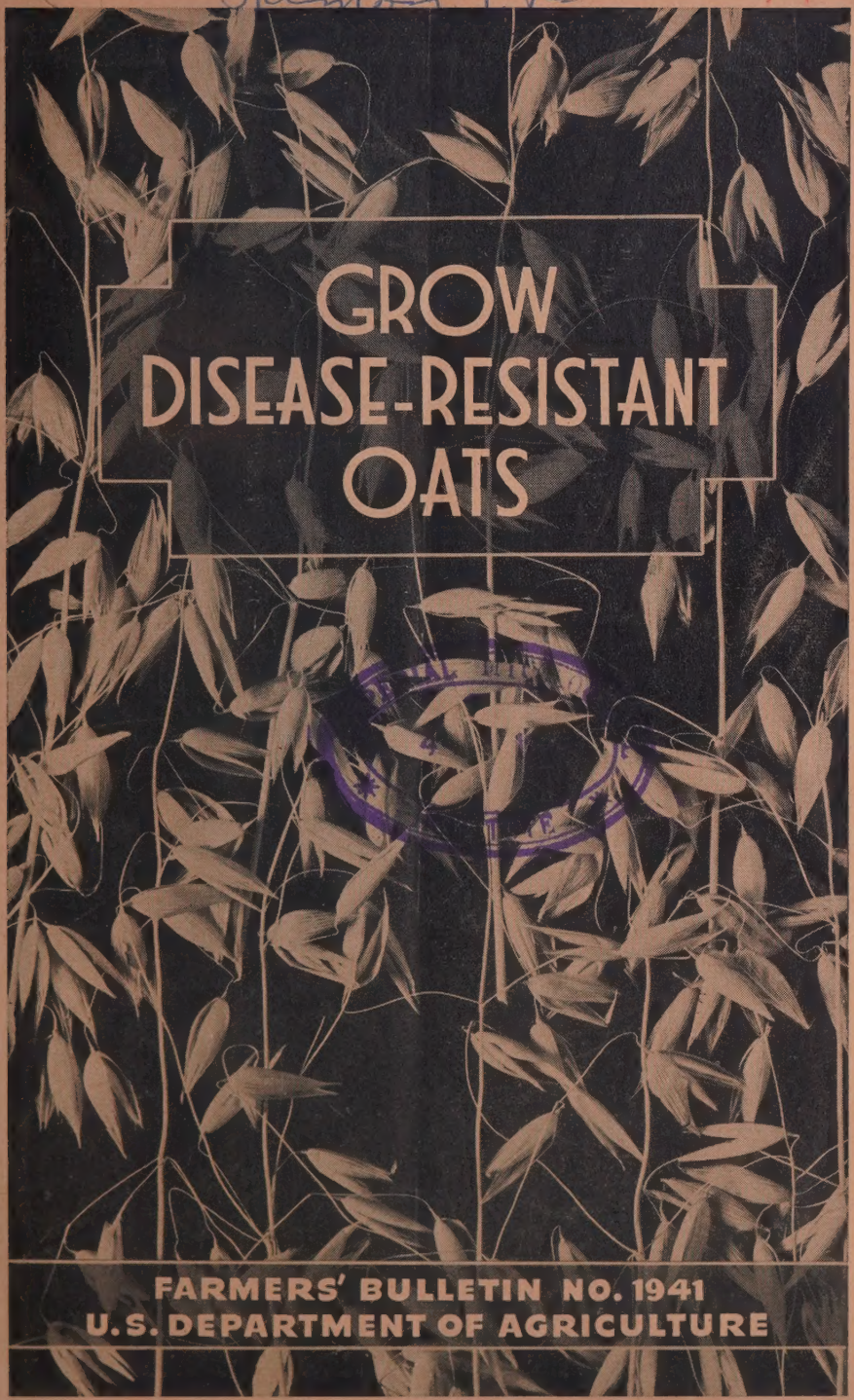
Stanton T R 1943



GROW DISEASE-RESISTANT OATS

FARMERS' BULLETIN NO. 1941
U.S. DEPARTMENT OF AGRICULTURE

Grow Disease-Resistant Oats

Produce More Oats on Fewer Acres in the North Central States

Make Oats a More Certain Crop

Varieties

Boone *Control* *Cedar*
Vicland *Tama* *Vikota*
Marion

Advantages

Resistance to oat rusts and smuts
Superior yielding power
High test weight
Early maturity
Fairly stiff straw, suitable for growing on rich soils
Slowness to sprout in the shock

Good Cultural Methods Pay Big Dividends

Prepare seedbed well
Seed early
Clean and treat seed
Use certified seed
Sow 8 to 10 pecks to the acre
Sow with drill

Washington, D. C. Issued October 1943

By T. R. STANTON, *senior agronomist,* and F. A. COFFMAN, *agronomist, Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration*

Development of Disease-Resistant Varieties Most Opportune

NEARLY 38,000,000 ACRES OF OATS were harvested in 1942. The land requirements for emergency crops, however, mean that more oats will have to be grown on fewer acres in order to maintain the necessary and valuable feed supplies of this grain. This can be best accomplished by growing the new, high-yielding, disease-resistant varieties that have been developed for the North Central States. This group of States includes the most intensive and important oat-producing area in the entire world.

The development of these new varieties has been most opportune. Several are already highly important in Iowa, Wisconsin, Illinois, and other States. They have increased and stabilized acre yields with little additional cost at a time when increased feed supplies are urgently needed. Increased oat production will help support the expanding industries that supply the dairy, poultry, and meat products needed during the war. This would be especially true if a heavy

534405°—43

epidemic of crown rust should occur, in which event growers of these new varieties would be insured against loss.

The New Varieties

The most outstanding new disease-resistant varieties are Boone, Marion, Control, Tama, Vicland, Cedar, and Vikota. The accomplishment of combining high resistance to the rusts and smuts with high productiveness and desirable grain characters through hybridization has set a new record in oat improvement. These new varieties were developed, tested, increased, and distributed by State agricultural experiment stations in cooperation with the United States Department of Agriculture.

All the above-mentioned varieties except Marion originated from the same cross and all are very similar in plant and kernel characters. One of the parents of the cross is Victoria, an unadapted, very late, but vigorous variety with high resistance to most races of crown rust and to smut, introduced from South America. The other parent, Richland (Iowa 105), is a well-known early, productive Corn Belt variety with high resistance to most races of stem rust. The cross was made at the Arlington Experiment Farm, Arlington, Va., in 1930.

These new varieties are all early, yellow, short, rather stiff-strawed, somewhat similar to the Richland parent, but have the crown rust and smut resistance of the Victoria parent. (See illustration.) These varieties in some seasons have shown a susceptibility, though not serious, to halo blight, a minor oat disease. The grain of all is of good quality and high test weight as compared with older varieties,

Rust-resistant strains stand and mature normally. Rust-susceptible strains ripen prematurely and lodge. (Oat breeding nursery, Iowa Agricultural Experiment Station.)

Marion oats (agronomy farm, Iowa Agricultural Experiment Station).

especially in seasons when rust is severe. Although similar to one another, these varieties differ somewhat in extent of awning, slightly in height of plant, and in yield, quality, and size of grain when grown under varying conditions of climate and soil.

The selections giving rise to Boone, Cedar, and Control were grown in early generations in tests for resistance to the rusts and smuts at Ames, Iowa, Arlington Farm, Va., and Aberdeen, Idaho. Final tests, however, of Boone and Control for yield and quality were made at Ames and Kanawha, Iowa, and these varieties were distributed in that State in 1940. The value of Cedar became apparent in cooperative experiments at Lincoln, Nebr., and it was distributed in that State in 1943.

The most promising selection of 33 tested for resistance to the rusts and smuts and for yield and quality at the Wisconsin Agricultural Experiment Station, beginning in 1935, was named Vicland and distributed in 1941.

The selection that was later named Tama was developed in the cooperative experiments at Ames and Kanawha, Iowa. It was distributed in 1942. Several closely related selections were sent from Ames to the South Dakota Agricultural Experiment Station at Brookings in 1941 for testing, one of which was named Vikota, jointly by the Iowa and the South Dakota stations and distributed in 1943.

Marion is an early to midseason, medium-tall (see illustration above), rather distinct new type of oats differing from those just mentioned in having almost white grains with thin hulls and large groats. It originated from a cross between Markton and Rainbow made at the Arlington Farm in 1928. Markton, a smut-resistant, vigorous variety, very productive in rust-free years, was developed at Moro, Oreg., as a selection from an unnamed variety obtained from Turkey in 1903.

Markton is very susceptible to both rusts and therefore is not satisfactory for the Corn Belt. Rainbow originated as a selection from Green Russian at the North Dakota Agricultural Experiment Station, at Fargo, and is a very productive variety, with high resistance to stem rust but only moderate resistance to crown rust. The desirable characters of both Markton and Rainbow, including disease resistance, vigor, high yield, and high quality, have been combined in Marion. Because the straw of Marion is taller than that of the varieties discussed above, this variety is slightly more susceptible to lodging, especially on very rich soils.

Hancock, another variety resulting from the cross between Markton and Rainbow, was distributed by the Iowa Agricultural Experiment Station only as a "special purpose" oat. It has been recommended for combine harvesting when sown with sweetclover as a nurse crop. It is an early maturing, tall, yellow-kerneled oat with exceptionally stiff straw. Hancock has yielded no better than such older varieties as Richland and Iogold. It lacks resistance to crown rust and is not recommended where this disease is destructive. Hancock's excellent standing ability, however, has made it attractive to farmers.

Performance of the New Varieties

In Iowa

The new varieties Boone (see illustration), Control (see illustration), Tama, and Marion in 1938 and again in 1941, when crown rust caused severe damage, yielded about 60 bushels per acre, as compared with 32 bushels for the old well-known varieties Richland (Iowa 105),

Boone oats (Iowa Agricultural Experiment Station).

Control oats (Iowa Agricultural Experiment Station).

Gopher, and others that are susceptible to this disease, as indicated by extensive cooperative tests conducted at Ames and Kanawha. This is a gain of about 28 bushels. Also, in the rust-free (good) years 1939, 1940, and 1942, they outyielded the old varieties by 6 to 7 bushels, showing not only that they are resistant to crown rust and yield well in crown-rust years but that they are equally good or better in other years. The average gain in all years is about 12 bushels.

In the 1940 standard community grain trials conducted by the Iowa Agricultural Experiment Station and the Extension Service at 29 well-distributed points in Iowa, Boone slightly exceeded Tama in yield. In 1941, in 39 tests, Tama was slightly higher in yield. It outyielded Boone in the 1942 trials at 34 points by 4 bushels to the acre. The average yield of Tama for the 3 years was less than 2 bushels higher than that for Boone. Control was not included in these particular tests, but other tests show it to be about equal to Boone in yield.

Since these new disease-resistant varieties are on the average about equally productive, their superiority in yield is more definitely indicated when comparisons are made with leading commercial varieties, such as Gopher and Richland. In the standard community grain trials mentioned, Boone exceeded Gopher by about 2 bushels an acre and Richland by more than 7 bushels in 1940, a very favorable oat year. In 1941, when a very severe crown-rust epidemic was experienced (see illustration, p. 6), Tama and Boone exceeded these standard varieties by nearly 16 bushels an acre. In 1942, another more favorable oat year, the differences in favor of Tama and Boone over Gopher were about 9 and 6 bushels, respectively.

Results of a severe epidemic of crown rust. Varieties standing from left to right, Boone, Tama, Vicland, Hancock, and Marion. Those lodged or almost completely destroyed are Gopher, Kherson, and Iowar.

In these same standard community grain trials, Marion averaged about 2 bushels an acre less than Tama, or about the same as Boone. Marion often shows considerable resistance to crown rust, and, as indicated by the high yields, this was sufficient to give the variety considerable protection against the ravages of crown rust in the severe epidemics of 1938 and 1941.

These new disease-resistant oats also have been consistently higher in test weight than the old standard varieties. This improvement in quality is much more apparent in years of severe crown rust epidemics. For example, in 1941 in the Iowa standard community grain trials, the average test weights of Marion, Boone, and Tama were 30.5, 29.8, and 29.6 pounds, respectively, as compared with 25.8 and 25.4 pounds for Gopher and Richland, respectively (see illustration, p. 12). In such years the test weight of these new oats on farms frequently has exceeded that of the older varieties by 20 to 30 percent, or as much as 10 pounds to the bushel.

In Illinois

Marion has been the leading variety in average yield in tests conducted at agricultural experiment stations in Illinois and may be superior to the other varieties for much of the State, provided it does not lodge too much on the rich black soils. At Urbana, Marion averaged 70.3 bushels per acre, as compared with 67.7 bushels for Boone for 1939 to 1942. Columbia, the leading standard variety, averaged 60.7 bushels for the same years. Vicland and Control are also meeting with much favor on northern Illinois farms.

Vicland oats (Wisconsin).

In Wisconsin

Vicland's performance in Wisconsin (see illustration) has been even more striking. Reports from Wisconsin growers in 1941, a season in which crown rust was very destructive, show that the average yield of Vicland was 69 bushels per acre as compared with 41.5 bushels for the standard varieties, a difference of 27.5 bushels in favor of the improved variety. Farm yields as high as 120 bushels to the acre in Wisconsin were reported for Vicland in 1942. In nursery tests conducted by the Wisconsin Agricultural Experiment Station at Madison, Vicland exceeded State Pride, the leading standard variety for Wisconsin, by 20 to 25 bushels to the acre.

In South Dakota

Vikota is very promising for eastern South Dakota. In tests conducted by the South Dakota Agricultural Experiment Station at Brookings, Vikota outyielded Richland, the standard variety, by 29.2 bushels to the acre as an average for 1941 and 1942. Boone and Tama outyielded Richland by 27.5 and 27.3 bushels, respectively.

In Nebraska

Cedar yielded an average of 53.2 bushels, as compared with 49.5, 44.1, and 41.1 bushels for Otoe, Nebraska 21, and Iogold, respectively, all standard Nebraska varieties, in tests conducted by the Nebraska Agricultural Experiment Station and the United States Department of Agriculture at Lincoln during the 5 years 1938 to 1942. Cedar ranked first among the 18 varieties and selections tested in that period. The test weight of Cedar also has been superior to that of standard varieties in Nebraska.

In Other States

In southern Minnesota and in central and northern Indiana, the varieties Marion, Tama, and Vicland have produced high yields and appear to be well adapted. Tama and Vicland have grown well in southern Minnesota and are being distributed for commercial production. Boone is of promise for northeastern Kansas. The new varieties also have made high yields in varietal tests conducted by the Purdue University Agricultural Experiment Station at La Fayette, Ind. All have been about equally promising for Indiana, Marion and Vicland apparently being slightly better than others.

As a group, these new varieties, probably because of early maturity, have not been so promising for southern Michigan and parts of Ohio as in the States to the west.

In general, the shorter and stiffer strawed varieties, such as Boone, Tama, and Vicland, may be superior for the richer and more highly productive soils of the Corn Belt, especially where there is danger of lodging (see illustration below). Marion has shown some tendency to lodge on very fertile soils. On the other hand, on the more upland soils of the Corn Belt, Marion grows taller than Boone and Vicland, thus making for more convenient harvesting. Its thin hull and general excellent grain quality are desirable for the manufacture of rolled oats. These characters make Marion one of the best varieties to grow for the production of commercial oats in so-called cash grain areas.

Oats standing were resistant to rust; those lodged were susceptible and, consequently, were nearly destroyed by rust.

Hybrid Oats or So-Called Wonder Crops

In recent years, attempts have been made by certain seed dealers and salesmen to capitalize on so-called hybrid oats with claims that oat varieties originating from hybrids possess unusual vigor and increased yielding power similar to that found in first-generation hybrid corn. Because hybrid seed of oats can be produced only by pollinating each flower by hand, it is not possible to utilize the vigor of first-generation hybrids in this crop. As a consequence, there simply is no such a thing as a "hybrid" oat in the same sense that farmers have come to know and appreciate hybrid corn. The new disease-resistant varieties of oats are true-breeding; if mechanical mixtures of other varieties are prevented, new seed need not be purchased each year, as is necessary with hybrid corn.

These new oat varieties should not be considered in the category of so-called wonder crops, although they are definitely superior in yield to the old varieties in normal years and very much superior in years of severe rust epidemics. They are more productive than the older standard varieties simply because high yield and resistance to disease have been combined in the new varieties.

Oat varieties developed from hybrids do not deteriorate or run out if they are kept free from contamination with seed of other varieties of oats, weeds, and other grains. A farmer may be growing a badly mixed variety and not be fully aware of it, because many oat varieties are somewhat similar, and sometimes it is difficult to differentiate similar varieties one from the other. The best insurance of varietal purity is to use certified seed.

Cultural Methods

Seedbed and Seeding

Oats respond well to good cultural methods. The most desirable seedbed for oats is one that is firm beneath, with a few inches of loose, friable soil on top. It should contain sufficient moisture to insure prompt germination and satisfactory early growth. In most sections of the Corn Belt, where oats usually follow corn, it is as a rule excellent practice to disk the land before seeding (see illustration, p. 10), regardless of how the seed is to be sown. Drilling is preferable, although the endgate seeder for sowing oats is still popular on many farms because less work is required, and frequently more timely seeding is possible. Drilling requires less seed, insures sufficient covering, and places the seed at a uniform depth in the soil.

Rate of Seeding

Usually 8 to 10 pecks to the acre is the best seeding rate. The rate may be reduced somewhat if the obtaining of a satisfactory stand of clover and grass with the oats as a nurse crop is a major objective.

Preparing seedbed for oats by disking.

Early Seeding Usually Insures High Yields

The yield and bushel weight of oats can be increased by sowing early. In cooperative experiments at the Iowa Agricultural Experiment Station, deferred sowing, after the optimum date, decreased yields approximately 1 bushel per acre for each day of delay. Early seeding always has been good insurance for the production of a satisfactory crop of oats.

Seed Treatment Pays Big Dividends

All oat seed should be cleaned and treated with New Improved Ceresan or some other standard fungicide for the control of pythium root rots and seedling blights, even though the new varieties are resistant to smut. Complete or even partial control of these relatively little understood diseases may result in an increase of some 5 to 10 bushels per acre in certain sections. Cleaning and treating seed oats is always good practice, and it may pay high dividends. The additional cost involved for treating the seed is very low in comparison with the improvement in yield and quality of the ensuing crop.

Use Seed from Certified Fields

Whenever possible, seed from certified fields should be obtained for sowing. This is especially true of the new disease-resistant varieties. Every farmer should start with pure seed of these varieties, so as to gain the expected advantage from growing them and to be certain that any seed he may distribute in another year to his neighbor will be pure and typical of the variety desired.

Availability of Seed

For sources of seed of the new varieties, the oat grower should consult his local county agricultural agent or write to his State agri-

cultural college. In Iowa more than 1,500,000 bushels of the new disease-resistant varieties were produced in 1941. In 1942, Iowa probably produced about 20,000,000 bushels of Boone, Control, Tama, and Marion, which would have been sufficient for seeding the entire 1943 State acreage if all of the crop had been utilized for seed.

About 7,000 bushels of foundation-stock seed of Vicland were distributed to 276 growers of certified seed in Wisconsin in 1941. The increase that resulted provided sufficient seed for sowing a large part of the oat acreage of that State 2 years later.

In Illinois more than 7,000 acres of certified Marion and 800 acres of certified Boone and Tama were grown in 1942. Thus, sufficient seed of these varieties should be available for sowing almost the entire acreage of the State in 1944. In Indiana a few farmers produced certified seed of Marion and Vicland in 1942. Seed of Vikota in South Dakota and Cedar in Nebraska is being increased as rapidly as possible for distribution. It is probable, however, that a considerable acreage of Boone and Control oats was sown in these States in 1943. In other States, seed supplies of the new varieties are still limited.

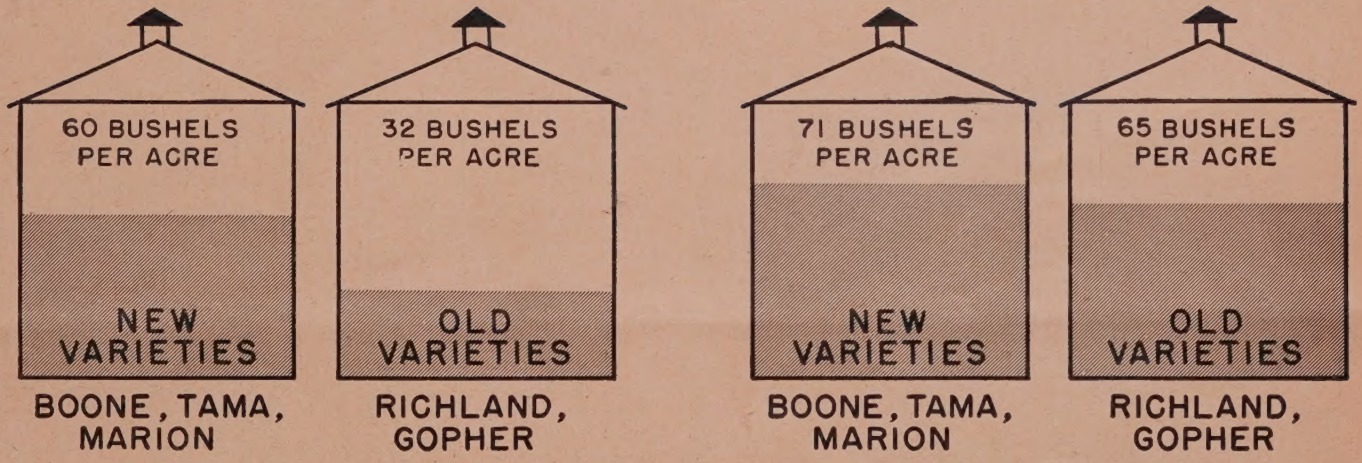
Write the agricultural college in your State or consult your county agricultural agent for names of growers of certified seed in your locality.

Effects of Crown Rust Infection on Yields

Damage to the Iowa oat crop caused by the severe crown-rust epidemics of 1938 and 1941 was exceedingly heavy. Only since the development of commercial varieties highly resistant to crown rust have the effects of this destructive disease become fully apparent. The striking results obtained in Iowa from the new disease-resistant varieties, in comparison with those from the standard varieties in 1938 and 1941, have been calculated in terms of reduction in acre yield due to the attacks of crown rust. The comparisons are shown in the following figure (illustration, p. 12).

The acre yields in 1938 and 1941 of the new disease-resistant varieties were 25 and 31 bushels, respectively, greater than those of the older varieties. These almost phenomenal differences definitely indicate the importance of sowing as many acres as possible of the new disease-resistant varieties, thus insuring against greatly reduced yields in case a severe crown-rust epidemic occurs.

The estimates of losses due to crown rust damage to the Iowa oat crop were obtained from the Plant Disease Survey of the Bureau of Plant Industry, Soils, and Agricultural Engineering. The average percentage of loss is proportionally lower than the calculated percentages of difference in favor of the new disease-resistant varieties.



New disease-resistant varieties make the difference between success and failure in years of severe crown rust infection and produce better yields in years of light or no crown rust infection.

This may be explained on the basis that either these new varieties carry factors for increased yield or the estimates of losses may be too low.

Although the new oats described in this bulletin have been highly resistant to the most common races of crown rust and stem rust, they are susceptible to a few that have been found only occasionally. Some of the less common, or little-known, as well as other races of crown rust may develop on the buckthorn bushes that occur in the area where these new varieties are adapted and start local epidemics. In a similar manner, the less common, little-known, dan other races of stem rust may develop and start local epidemics from the barberry bushes that have not as yet been removed from the area. The eradication of these bushes will help to safeguard the advances thus far made by the development of these new resistant varieties.

U. S. GOVERNMENT PRINTING OFFICE: 1943

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington, D. C. - Price 5 cents